

THE MINUTE PIRATE-BUG GENUS *XYLOCORIS* DUFOUR (HEMIPTERA:  
HETEROPTERA: ANTHOCORIDAE) FROM RICE MILLS IN THAILAND

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*Abstract.*—Three species of the anthocorid genus *Xylocoris* Dufour are reported from rice mills in southern Thailand. They are considered effective biological control agents against stored-product insect pests. Two of them, belonging to the subgenus *Proxylocoris* Carayon, are described as new: *X. cerealis* Yamada and Yasunaga, n. sp., and *X. hyalinipennis* Yamada and Yasunaga, n. sp. A key is provided to help distinguish these species.

*Key Words:* Heteroptera, Anthocoridae, *Xylocoris*, new species, Thailand, biological control

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*Xylocoris* Dufour, 1831, is a large anthocorine flower bug genus, comprising about 50 species in the world, principally in the Holarctic Region (e.g., Chu 1969, Henry 1988, Péricart 1996). These bugs usually prey on various small arthropods, and some have been reported to be effective natural enemies against pests in stored-food facilities and grain mills (e.g., Péricart 1972, Lattin 2000). It is necessary to accurately identify species to establish modern taxonomic research for such natural enemies. There is no adequate taxonomic study on the genus *Xylocoris* in the Oriental Region.

During continuing investigations of rice mills in Thailand, Nakatani collected three species of *Xylocoris*. One of them is

*X. (Arrostelus) flavipes* (Reuter, 1875), a well-known predator of stored-product insect pests. The other two represent undescribed species belonging to the subgenus *Proxylocoris* Carayon, 1972. Two species, *Xylocoris* (*Proxylocoris*) *cerealis* and *X. (P) hyalinipennis*, are described here as new, and the well-known *X. (A.) flavipes* is diagnosed. In addition to diagnoses and descriptions of these three species, biological information on *Xylocoris* in rice mills is documented, and key is provided to distinguish the three *Xylocoris* species from rice mills in Thailand.

#### MATERIALS AND METHODS

Dried specimens of each species were used. For genitalic observations, the

entire abdomen was removed from the body, soaked in 5% hot KOH solution for 3–5 minutes, and placed into glycerin on a glass slide. Illustrations of the structure were drawn with the aid of a Nikon Stereoscopic Zoom Microscope SMZ1500. Scanning electron microscopy was used to observe the details of surface structures.

Depositories of material are abbreviated as follows: National Institute of Agro-Environmental Sciences, Tsukuba (NIAES); Entomological Laboratory, Osaka Prefecture University, Sakai (OPU). Abbreviation is used for the collector of the specimens examined: YN (Yukinobu Nakatani). All measurements are given in millimeters. Only selected references are cited for each taxon; see the catalogue of Péricart (1996) for further information. Terminology for descriptions follows Carayon (1972).

#### TAXONOMY

##### Genus *Xylocoris* Dufour

*Xylocoris* Dufour 1831: 423. Type species by monotypy: *Xylocoris rufipennis* Dufour 1831.

Diagnosis.—Recognized by the oval to elongate-oval body, dorsum shining and smooth, pronotum with stout, long, suberect corner setae, well-developed fossula spongiosa at apex of foretibia, midtibia bears smaller fossula spongiosa, stout, long spines distributed along predominant part of the metatibia, sickle-shaped paramere curved toward the posterolateral end and ectospermalege usually opening at right side of abdominal terga III and VIII in female.

Remarks.—This genus is divided into four subgenera, *Xylocoris* s. str., *Proxylocoris* Carayon, *Arrostelus* Kirkaldy, and *Stictosynechia* Reuter, based on the position of the tibial teeth in the male and the surface structure of the ostiolar

peritreme, besides the peculiar copulatory direction.

All species of *Xylocoris* are predaceous and often found in habitats such as under the bark of trees, among dead plant materials, and in litter layers of shaded forests. A few species are found in stored-food facilities, especially grains, and preferably prey on small arthropods. Some species have brachypterous, subbrachypterous, and macropterous forms.

##### Subgenus *Proxylocoris* Carayon

*Proxylocoris* Carayon 1972: 594 (as a subgenus of *Xylocoris*). Type species by original designation: *Piezostethus afer* Reuter 1884.

Remarks.—*Proxylocoris* is distinguished from other subgenera by a combination of the following characters: male fore- and midlegs with tibial teeth always present, row of tibial teeth on midleg longer than that of foreleg; canaliculi of ostiole distinct and densely distributed (Figs. 8–9); ectospermalege placed between abdominal terga II and III (Figs. 17, 21).

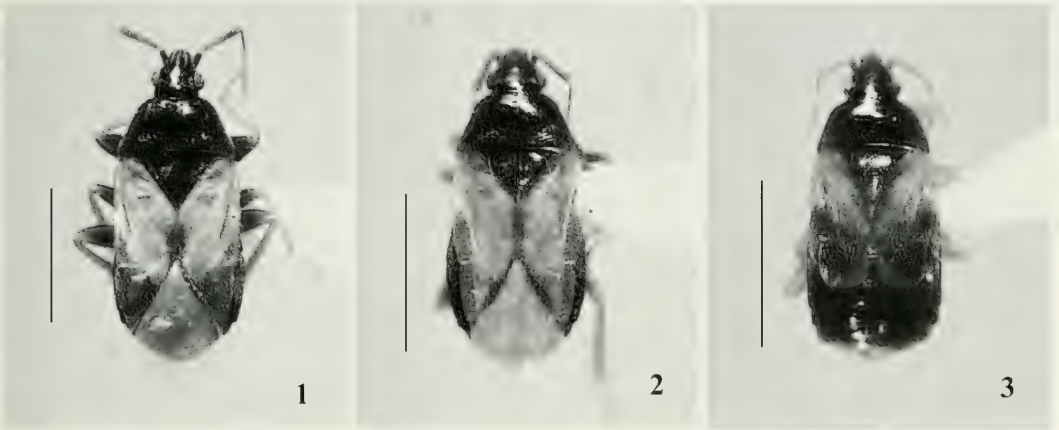
This subgenus has contained approximately 20 species; most of these are distributed in the Palearctic Region (Péricart 1996). A single member, *X. clarus* (Distant, 1910), is known from the Oriental Region (India and Myanmar).

##### *Xylocoris (Proxylocoris) cerealis* Yamada and Yasunaga, new species

(Figs. 1, 4, 8, 11–14)

*Xylocoris (Proxylocoris)* sp. 1: Nakatani 2004: 38.

Diagnosis.—Recognized by the shiny, oblong-oval body, semi-transparent hemelytron, infuscate clavus and corium that are darkened along the inner margin with a dark subtriangular spot at the mesial inner margin (Fig. 4), medially angulate paramere in posterior view

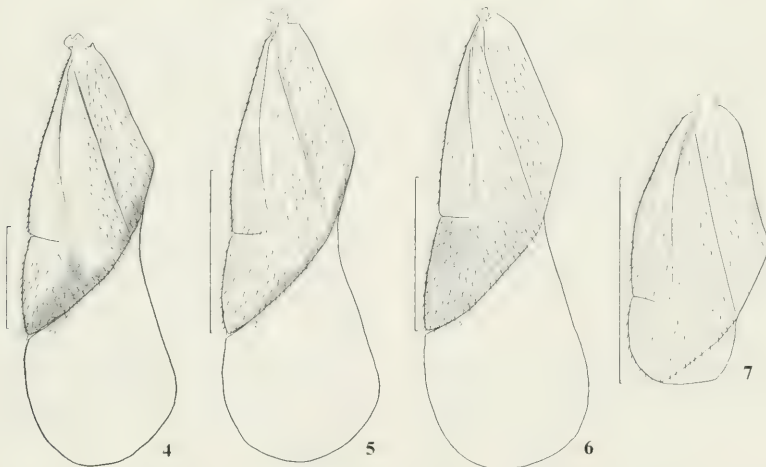


Figs. 1–3. *Xylocoris* spp. from Thailand. 1, *X. (Proxylocoris) cerealis*, ♂. 2, *X. (P.) hyalinipennis*, ♀. 3, *X. (Arrostelus) flavipes*, ♀, subbrachypterous. Scale bars: 1.0 mm.

(Fig. 13), and much smaller, weakly sclerotized ectospermalege (Fig. 14).

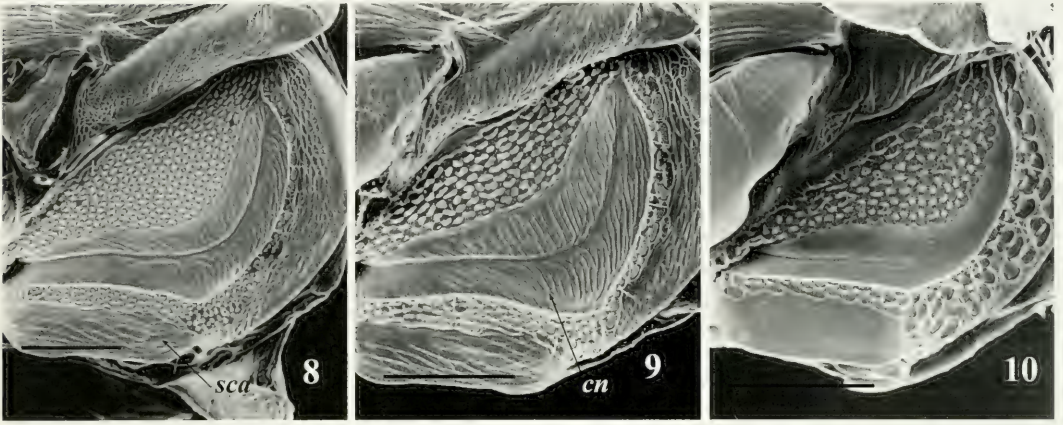
Description.—Body (Fig. 1) oblong-oval; dorsal surface shiny, with pale yellow, short, reclining pubescence. Head (Fig. 1) blackish brown, smooth, head about 0.8 times as long as wide across eyes; apex of head tinged with pale yellow; three pairs of long, erect setae on each side of tylus, near anterior inner margin of eyes, and between eyes and ocelli; length of antecular portion as long as eye in dorsal view; vertex 3.6 times as wide as eye in dorsal view; ocelli

reddish brown. Antenna yellowish brown; segment I dark brown, almost reaching to apex of head, with sparse, short setae; segment II tinged with dark brown on apical  $\frac{1}{3}$ , thickened toward apex, about 0.78 times as long as width of head, with densely distributed, reclining setae; segments III and IV each shorter than segment II, with sparsely distributed, long, suberect setae; segment III slightly shorter than IV; length of segments I–IV (♂/♀): 0.16/0.16, 0.38/0.40–0.41, 0.31/0.31–0.34, and 0.34/0.34–0.38. Rostrum yellowish brown, attain-



Figs. 4–7. Left forewings of *Xylocoris* spp. 4, *X. (Proxylocoris) cerealis*. 5, *X. (P.) hyalinipennis*. 6, 7, *X. (Arrostelus) flavipes*, macropterous and subbrachypterous. Scale bars: 0.5 mm.





Figs. 8–10. Ostiolar peritremes of *Xylocoris* spp. in left lateroventral view. 8, *X. (Proxylocoris) cerealis*. 9, *X. (P.) hyalinipennis*. 10, *X. (Arrostelus) flavipes*. Scale bars: 0.1 mm. Abbreviations: sca = supracoxal area; cn = canaliculi.

ing base of mesocoxae; segment I and basal half of segment II tinged with dark brown; segment III more than twice as long as II.

Pronotum (Fig. 1) varying from black to blackish brown, sparsely pubescent, with posterior half weakly depressed and transversely strigose; collar incomplete; anterior margin of pronotum curved, slightly shorter than mesal length; lateral margin nearly straight; posterior margin slightly concave, twice as long as anterior margin. Scutellum black to blackish brown, apex pale yellow, anterior  $\frac{1}{3}$  of lateral side bearing long, suberect setae. Hemelytron (Figs. 1, 4) semitransparent, tinged with yellowish brown, with sparsely distributed, short, reclining pubescence and minute punctures; clavus and corium darkened along inner margin, with dark subtriangle spot at mesial inner margin; membrane transparent, with indistinct vein. Ostiolar peritreme (Fig. 8) brown; ostiole wide, curved anteriorly; apex of ostiole not reaching anterior margin of metapleuron; supracoxal area with transverse rows of furrows. Legs yellowish brown, stout, with densely distributed, pale yellow pubescence; each femur dark brown, with apex slightly yellowish; each tibia

bearing long, stout spines. Abdomen blackish brown; scissure on abdominal terga reaching segment III.

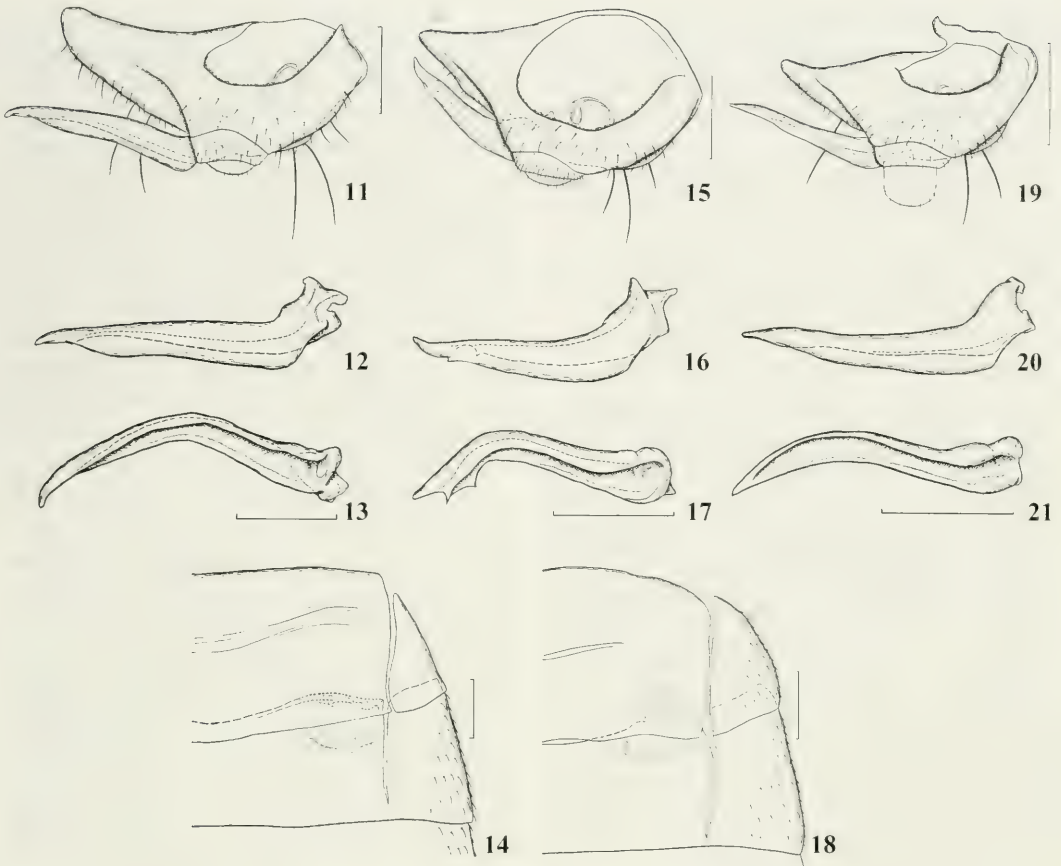
*Male genitalia* (Figs. 11–13): Pygophore longitudinally narrow and basally constricted, posteroventrally with long setae; longest setae slightly shorter than half of paramere; paramere medially angulate, slightly bent at apex.

*Female genitalia* (Fig. 14): Ectospermae much smaller than that of *X. galactinus* and *X. hiurai* and weakly sclerotized, extending posteriorly.

*Measurements*: ♂/♀: Body length 2.75/2.88–3.08; head length (excl. neck) 0.41/0.39–0.41; head width (incl. eyes) 0.48/0.51; vertex width 0.30/0.32–0.34; width between ocelli 0.23/0.26; rostral length 0.91/0.97–1.03; anterior pronotal width 0.43/0.39–0.43; mesal pronotal length 0.47/0.47–0.48; basal pronotal width 0.98/1.06–1.09; length of embolial margin 0.90/0.94–1.00; length of lateral cuneal margin 0.50/0.48–0.50; maximum width across hemelytra 1.05/1.15–1.20.

*Holotype*.—♂, THAILAND: Songkhla Prov., Ranode, Rice mill factory, N07-48' E100-16', 11. xi. 2002, Y. Nakatani (NIAES).

*Paratypes*.—THAILAND: 1 ♀, Nakhon Si Thammarat, N08-15' E100-01',



Figs. 11–21. Male (11–13, 15–17, 19–21) and female (14, 18) genitalia of *Xylocoris* spp. 11–14, *X. (Proxylocoris) cerealis*. 15–18, *X. (P.) hyalinipennis*. 19–21, *X. (Arrostelus) flavipes*. 11, 15, 19, Pygophores in dorsal view; 12, 16, 20, parameres in dorsal view; 13, 17, 21, parameres in posterior view; 14, 18, ectospermalege in dorsal view. Scale bars: 0.1 mm.

16. xi. 2002, YN (OPU); 1 ♀, Nakhon Si Thammarat, N08-23' E100-02', 15.xi.2002, YN (OPU); 1 ♀, same data as holotype (NIAES).

Distribution.—Southern Thailand.

Etymology.—From the Latin “*cerealis*” (= of grain), referring to its habitat in cereal stocks in Thailand; an adjective.

Remarks.—In general appearance, this new species resembles the cosmopolitan *X. galactinus* (Fieber, 1836) and the temperate eastern Asian inhabitant *X. hiurai* Kerzhner and Elov, 1976. *Xylocoris cerealis* is distinguished from *X. galactinus* by the apex of ostiolar canal not extending to the anterior margin of the metapleuron (reaches the anterior

margin of metapleuron in *X. galactinus*), medially angulate paramere (strongly curved in *X. galactinus*), and much smaller ectospermalege (rather larger ectospermalege in *X. galactinus*), and from *X. hiurai* by the weakly sclerotized and posteriorly extended ectospermalege (more darkened and obscure, subtriangular, and anteriorly broadened in *X. hiurai*).

*Xylocoris (Proxylocoris) hyalinipennis*  
Yamada and Yasunaga, new species  
(Figs. 2, 5, 9, 15–18)

*Xylocoris (Proxylocoris)* sp. 2: Nakatani 2004: 38.



**Diagnosis.**—Recognized by the much smaller body, mostly hyaline hemelytron that is tinged with ocherous, infuscate clavus and corium that are narrowly darkened along inner margins (Fig. 5), ostiolar peritreme accompanying narrow evaporative area and widened ostiole (Fig. 9), the strongly curved apical  $\frac{1}{3}$  of the paramere that is furnished with a bifurcate process subapically (Fig. 17), and the anteriorly broadened ectospermalege (Fig. 18).

**Description.**—Body (Fig. 2) elongate oval; dorsal surface shiny, with bright yellow, short, reclining pubescence. Head (Fig. 2) blackish brown, smooth, about 0.75 times as long as width across eyes; apex of head broadly tinged with pale yellow; a pair of erect setae present at each side of tylus near anterior inner margin of eye, and between eye and ocellus; antocular portion slightly longer than eye in dorsal view; vertex 3.8 times as wide as eye in dorsal view; ocelli red. Antenna yellowish brown; segment I nearly extending to apex of head, with sparsely distributed, short setae; segment II sometimes tinged with dark brown at apex, gradually thickened toward apex,  $\frac{3}{4}$  as long as head width, with densely distributed, reclining setae; segments III and IV, each almost equal in length to II, with sparsely distributed, long, suberect setae; length of antennal segments I–IV ( $\delta/\text{♀}$ ): 0.13/0.13, 0.30/0.31, 0.30/0.30–0.31, 0.30/0.29–0.30. Rostrum yellowish brown, extending to base of mesocoxae; segment III about twice as long as II.

Pronotum (Fig. 2) black to blackish brown, sparsely pubescent, with weakly depressed posterior half; collar indistinct; anterior margin of pronotum curved, about as long as mesal length; anterior humeri rounded; lateral margin nearly straight; posterior margin slightly curved, slightly more than twice as long as anterior margin. Scutellum black to blackish brown; anterior  $\frac{1}{3}$  of lateral

side bearing long, suberect setae. Hemelytron (Figs. 2, 5) nearly transparent, tinged with yellowish brown, with sparsely distributed, short, reclining pubescence and minute punctures; clavus and corium narrowly darkened along inner margin; membrane transparent, with indistinct veins. Ostiolar peritreme (Fig. 9) brown, with narrow evaporative area and rather broadened ostiole curved anteriorly; apex of ostiole almost reaching anterior margin of metapleuron; supracoxal area with transverse furrows. Legs yellowish brown, stout, densely clothed with pale yellow pubescence; each femur dark brown, tinged with yellowish brown at apex; each tibia bearing long stout spines. Abdomen blackish brown; scissure on abdominal terga extending to segment III.

**Male genitalia** (Figs. 15–17): Pygophore basally narrow; paramere arising near posteroventral angle of pygophore, extending to near median projection on left margin of pygophore in dorsal view, strongly curved at apical  $\frac{1}{3}$  in posterior view, with subapical conspicuous, bifurcate process.

**Female genitalia** (Fig. 18): Ectospermalege anteriorly broadened, with a complexly folded thin duct at right lateral margin.

**Measurements:**  $\delta/\text{♀}$ : Body length 2.25/2.30–2.38; head length (excl. neck) 0.30/0.31–0.32; head width (incl. eyes) 0.40/0.43; vertex width 0.28/0.27–0.28; width between ocelli 0.20/0.22–0.23; rostral length ?/0.97–1.03 ( $\delta$ : apical two segments lost); anterior pronotal width 0.34–0.36/0.36–0.38; mesal pronotal length 0.38–0.43/0.38–0.40; basal pronotal width 0.77–0.78/0.83–0.85; length of embolial margin 0.70/0.70–0.74; length of cuneal margin 0.35/0.38–0.40; maximum width across hemelytra 0.85/0.86–0.88.

**Holotype.**— $\text{♀}$ , THAILAND: Nakhon Si Thammarat, Rice mill factory, N08-23' E100-02', 15.xi.2002, Y. Nakatani (NIAES).

Paratypes.—THAILAND: 1 ♂, 1 ♀, same data as for holotype (NIAES); 1 ♂, 1 ♀, Nakhon Si Thammarat, N08-15' E100-01', 16.xi.2002, YN (OPU); 2 ♀, Songkhla Prov., Ranode, N07-48' E100-16', 11.xi.2002, YN (OPU).

Distribution.—Southern Thailand.

Etymology.—From the Latin “*hyalinus*” (= transparent), combined with “*pennis*” (= wing), referring to the nearly transparent hemelytra; an adjective.

Remarks.—This new species is very similar to *X. clarus* (Distant, 1910) in the coloration of the hemelytra and appearance of female genitalia from which it is distinguished by the apex of the paramere extending to near median projection on left margin of pygophore (apex of paramere extending well beyond median projection on left margin of pygophore in *X. clarus*) and the complexly folded thin duct at right lateral margin of ectospermalege (simple, vague, and conical ectospermalege in *X. clarus*).

This new species is allied to former species, but may be distinguished by smaller body size, narrowly darkened along inner margin of clavus and corium, narrow evaporative area, broadened ostiole, and subapically curved paramere with a characteristic bifurcate process.

#### Subgenus *Arrostelus* Kirkaldy

*Arrostus* Reuter 1884: 35 (as subgenus of *Piezostethus*) (junior homonym of *Arrostus* Fährus 1872, Coleoptera). Type species by monotypy: *Piezostethus flavipes* Reuter 1884.

*Arrostelus* Kirkaldy 1906: 119. New name for *Arrostus* Reuter.

Remarks.—This subgenus may be separated from other subgenera by a combination of the following characters: male tibial teeth always absent; supracoxal area of metapleuron distinct (Fig. 10); ectospermalege always absent; and copulation site and cicatrices present on anterodorsal area of abdomen.

Four species, *X. congoensis* (Bergroth, 1905), *X. flavipes* (Reuter, 1875), *X. hirsutus* Carayon, 1961, and *X. queenlandicus* Gross, 1956, are known to occur in the tropical and subtropical zone around the world (Chu 1969, Péricart 1996).

*Xylocoris (Arrostelus) flavipes* (Reuter)  
(Figs. 3, 6, 7, 10, 19–21)

*Piezostethus flavipes* Reuter 1875: 65.

Diagnosis.—Recognized by the small (1.8–2.2 mm), elongate-oval body (Fig. 3); dark brown head (Fig. 3) with pale yellow tylus; pale yellow antenna and rostrum; dark brown, unicolorous, highly polished, almost impunctate, and sparsely pubescent pronotum (Fig. 3); yellowish-brown hemelytron (Figs. 3, 6–7), broadly darkened cuneus in macropterous form, corium and cuneus that are sometimes narrowly darkened in subbrachypterous form; ostiolar peritreme (Fig. 10) with a smooth ostiole and supracoxal area; entirely pale yellow legs; pygophore (Fig. 19) with characteristic process basally; and moderately curved paramere (Figs. 20–21).

*Measurements:* ♂/♀: Body length 1.80–1.88/2.00–2.25; head length (excl. neck) 0.29–0.30/0.30–0.34; head width including compound eyes 0.35–0.36/0.38–0.41; vertex width 0.24–0.26/0.24–0.26; width between ocelli 0.19–0.21/0.19–0.21; rostral length 0.81–0.84/0.81–0.88; pronotal anterior margin width 0.31–0.32/0.34; mesal pronotal length 0.32–0.34/0.34–0.36; basal pronotal width 0.61–0.64/0.70–0.82; length of embolial margin 0.50–0.53/0.55–0.74 in subbrachypterous, ?/0.65–0.75 in macropterous; length of cuneal margin 0.20–0.22/0.24–0.27 in subbrachypterous, ?/0.40–0.45 in macropterous; maximum width across hemelytra 0.70–0.72/0.78–0.80 in subbrachypterous, ?/0.80–0.90 in macropterous.



*Specimens examined:* (Subbrachypterous form: subbrac.; macropterous form: mac.) THAILAND: 3 ♂, 1 ♀ (subbrac.), Nakhon Nayok, N14-16' E101-04', 2.xi.2002, YN (OPU); 1 ♀ (subbrac.), Nakhon Si Thammarat, N08-24' E100-00', 15.xi.2002, YN (OPU); 4 ♀ (2 subbrac., 2 mac.), Nakhon Si Thammarat, N08-23' E100-02', 15.xi.2002, YN (NIAES); 2 ♀ (1 subbrac., 1 mac.), Phatthalung, N07-36' E100-07', 12.xi.2002, YN (NIAES).

*Distribution.*—Europe, northern and tropical Africa, Asia (Turkey, Saudi Arabia, Yemen, Pakistan, India, Indonesia, Thailand, China), Australia, North America (U.S.A), South America.

#### KEY TO *XYLOCORIS* SPECIES FOUND IN RICE MILLS IN THAILAND

1. Hemelytron yellowish brown, with darkened cuneus; femora unicolorous pale yellow; ostiole smooth, lacking canaliculi . . . . . *X. (Arrostelus) flavipes*
- Hemelytron mostly transparent or semi-transparent; femora dark brown; ostiole with canaliculi . . . . . 2
2. Body larger (about 3.0 mm long); clavus and corium darkened along inner margins with a dark, subtriangular spot at mesial inner margin; paramere angulate medially . . . . . *X. (Proxycorisis) cerealis*
- Body smaller (about 2.3 mm long); clavus and corium narrowly darkened along inner margin; paramere curved subapically, with characteristic bifurcate process . . . . . *X. (P.) hyalinipennis*

#### BIOLOGY

Visarathanonth and Sukprakarn (1988) reported 72 species of stored-product insect pests from Thailand. Present investigations of rice mills, the following insect species were found from rice bran and polished rice: *Rhyzopertha dominica* (Fabricius) (Coleoptera, Bostrichidae), *Lophocateres pusillus* (Klug) (Col., Trogossitidae), *Oryzaephilus surinamensis* (Linnaeus) (Col., Silvanidae), *Cryptolestes pusillus* (Schonherr) (Col., Cucujidae), *Tribolium castaneum* (Herbst) (Col., Tenebrionidae), *Sitophilus* spp. (Col., Cur-

culionidae), *Corcyra cephalonia* (Stainton) (Lepidoptera, Pyralidae), and *Sitotroga cerealella* (Oliver) (Lep., Gelechiidae). They have been documented as major pests of paddy and milled rice.

*Xylocoris flavipes* is known to prey on many developmental stages of various coleopteran and lepidopteran pests (Jay et al. 1968, Arbogast et al. 1971). In addition, *X. sordidus* is known to inhabit stored grain facilities in North and South America. The cosmopolitan species *X. galactinus* is a known predator of various insects found in the stored-grain habitats (Chu 1969, Péricart 1972). Thus some stored-food insect pests can be regarded as prey of the anthocorid species reported here. *Xylocoris flavipes* is the only species known previously from Thailand (Visarathanonth et al. 1994). This species is widely distributed in temperate, subtropical, and tropical zones of the world. The native range of this species is difficult to determine because it has been transported to so many parts of the world in commerce (Lattin 2000).

*Xylocoris flavipes* is the most common in rice mill inhabitant in Thailand. In contrast, *X. cerealis* and *X. hyalinipennis* appear to be restricted in distribution and currently are found only in the southern Thailand, where they co-occur with *X. flavipes* in Phatthalung.

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